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Small Grains for Profit

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Acknowledgment

This bulletin is another in the series arising out of a request from the Manitoba Agronomists' Conference for publications from which farmers may obtain up-to-date information. The material was prepared by P. J. Olson, University of Manitoba; R. F. Peterson, Dominion Laboratory of Cereal Breeding; W. E. Sackston, Dominion Laboratory of Plant Pathology; and P. H. Ford, Manitoba Department of Agriculture. The final preparation of the Bulletin was in the hands of an editorial committee appointed by the Conference, consisting of: H. S. Fry, Q. H. Martinson, F. J. Greaney, H. A. Craig, and H. E. Wood.

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Small Grains For PROFIT

VARIETIES

Each year the Conference of Manitoba Agronomists makes recommendations of cereal and flax varieties for growing in Manitoba for the following year. Only recommended varieties for 1952 are discussed in this publication. The varieties are selected on the basis of their performance on farms as well as in controlled tests conducted by experimental farms, illustration stations, the University of Manitoba, grain companies, and other organizations. For details as to the zones for which each variety is recommended the reader is referred to the folder "Field Crop Recommendations for Manitoba" published by the Manitoba Department of Agriculture.

Common Wheat

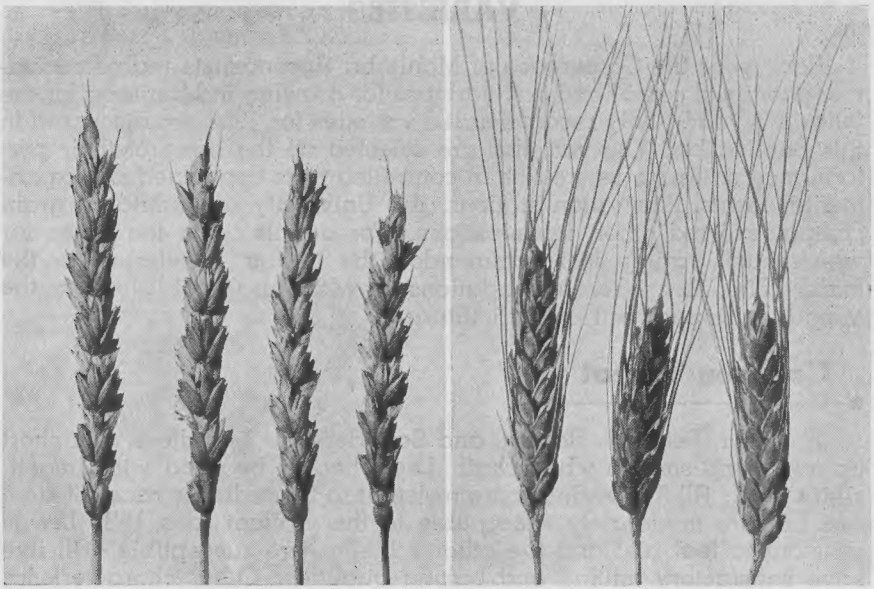
Thatcher, Redman, Regent, and Saunders are beardless with short tip awns and smooth white chaff. Lee wheat is bearded with smooth white chaff. All five varieties are resistant to the ordinary races of stem rust but are moderately susceptible to the virulent race 15B. Lee is resistant to leaf rust and the other varieties are susceptible. All five have satisfactory milling and baking qualities. Other characteristics are described below with the well-known variety, Thatcher, used as a basis of comparison.

Thatcher—The University of Minnesota in co-operation with the United States Department of Agriculture developed this variety from the cross (Marquis x Iumillo) x (Marquis x Kanred). It was licensed in Canada in 1935, and considerable stocks were released for seeding in 1936. Thatcher has early maturity, strong straw of medium length, and resistance to shattering. The kernels are small and tend to bleach when exposed to weathering. Thatcher is resistant to loose smut and black chaff, moderately resistant to common root-rot, but susceptible to leaf rust and bunt (covered smut). It is a high yielder in all parts of the province when leaf rust is not severe. At the peak of its popularity in 1941, it occupied over 60% of the wheat acreage of this province.

Redman—This wheat was developed at Winnipeg by the Dominion Laboratory of Cereal Breeding, in co-operation with the Dominion Laboratory of Plant Pathology, from the cross Regent x Canus made

in 1934, and was released to farmers in 1947. Compared with Thatcher it has slightly earlier maturity, stronger straw of equal length, equal yield and resistance to shattering. The kernels are larger, of better color, and less subject to bleaching. Redman is resistant to bunt and black chaff, moderately resistant to loose smut and root-rot, and moderately susceptible to leaf rust.

Regent—This variety, from the same laboratory as Redman, resulted from the cross H44 x Reward made in 1926, and was released to farmers in 1939. It is similar to Redman in appearance and disease reactions, but gives lower yields in most localities and is less widely adapted. For these reasons Regent is being steadily replaced by Redman.



Wheat Varieties. Left to right—Redman, Regent, Renown. Thatcher, Carleton, Stewart, Mindum

Saunders—The Cereal Division, Central Experimental Farm, Ottawa, developed this variety from the cross Thatcher x (Hope x Reward) made in 1938, and released it to farmers in 1948. Compared with Thatcher it is about two days earlier maturing, has slightly stronger and shorter straw, and kernels of better size and color. Saunders is resistant to loose smut, moderately resistant to bunt and root-rot, and moderately susceptible to leaf rust and black chaff. It yields less than Thatcher, Redman, and Regent, but is recommended as a second choice in zone 4B (Swan River Valley) to be used when early maturity is required. The acreage of Saunders has been very small.

Lee—A bearded variety, Lee was developed by the University of Minnesota in co-operation with the United States Department of Agriculture from the cross Hope x Timstein made in 1939. It was received in Canada for testing in 1947, and was licensed in 1950. In 1951, approx-

imately 8,000 bushels of seed of Lee were produced under contract by the Dominion Laboratory of Cereal Breeding, Winnipeg. This stock was distributed to Crop Improvement Clubs, Junior Seed Clubs, seed growers, and farmers at large. Compared with Thatcher, Lee is about two days later maturing, has slightly shorter and weaker straw, and larger kernels of better color. Lee is resistant to leaf rust and root-rot, and susceptible to bunt and loose smut. Lee yields more than the other recommended varieties when leaf rust is severe, but about the same as Thatcher and Redman when leaf rust is not a factor.

Durum Wheat

The three recommended varieties (Mindum, Stewart, and Carleton) are similar in appearance, having light brown chaff and awns, and amber kernels. They require about one week more than the bread wheats to mature. All three are resistant to leaf rust, and to the ordinary races of stem rust. However, they are more susceptible to stem rust race 15B, than the bread wheats. All are rated high in quality for the manufacture of macaroni, spaghetti and similar products. Other characteristics are described below, with the well-known variety, Mindum, used as a standard of comparison.

Mindum—Originally developed at the University of Minnesota, this was long the main durum variety in Manitoba, but is being replaced by the stronger-strawed varieties, Stewart and Carleton. Mindum has longer and weaker straw than Thatcher and other bread wheats.
Stewart—This variety was developed by the North Dakota Agricultural Experiment Station by making the cross Mindum x Vernal Emmer, and backcrossing the selected rust resistant hybrids twice with Mindum. Stewart was released in Canada in 1946. The most recent strain of Stewart, known as Stewart 221, has still another backcross of Mindum, and yields slightly more than the original stock. Stewart 221 was released in 1950. Compared with Mindum, Stewart has stronger straw and higher yield.

Carleton—The North Dakota Station also developed Carleton by crossing Vernal Emmer with Mindum and backcrossing the selected rust resistant hybrids twice with Mindum. Carleton has stronger straw than either Mindum or Stewart, but is less widely adapted. The comparative yields of Carleton and Stewart depend upon conditions. When grown on summerfallow in the Red River Valley, Carleton usually equals Stewart in yield. On lighter, drier soils, or on second crop land Stewart yields more than Carleton.

Oats

The four recommended varieties, Exeter, Ajax, Vanguard, and Fortune, are all resistant to most of the prevalent races of stem rust, but lack resistance to race 8.

Exeter—This variety was developed at Winnipeg by the Dominion Laboratory of Cereal Breeding in cooperation with the Dominion Laboratory of Plant Pathology, from the cross Victory x Rusota made in 1929, and was released to farmers in 1944. Compared with Victory it is higher yielding, equal in maturity (medium late), and has slightly weaker straw. It is susceptible to crown rust (leaf rust), moderately susceptible to smut, and moderately resistant to halo blight. Exeter is well adapted to all zones, but particularly to the northern zones.

Ajax—This oat originated from the same laboratory as Exeter from the cross Victory x Hajira made in 1930, and was released in 1943. It is an early-maturing variety with strong straw. Ajax yields slightly more than Exeter in the southern part of Manitoba but less than Exeter in other areas. It is moderately resistant to crown rust and smut, and resistant to halo blight.

A clean heavy stand of barley

Vanguard—Originating from the same institution as Exeter and Ajax, Vanguard resulted from the cross Hajira x Banner made in 1926, and was distributed in 1936. Vanguard was the first oat variety resistant to stem rust distributed in Canada. It is a medium-early variety, yielding less than Exeter and Ajax, and is being steadily replaced by those varieties. It is susceptible to crown rust and smut, and resistant to halo blight.

Fortune—This oat was developed by the University of Saskatchewan from the cross Victory x (Victoria x Richland) x (Markton x Victory), and was released in 1948. Compared with Exeter, it is similar in type, slight-

ly earlier maturing, with somewhat stronger straw, but lower yield in Manitoba. It is susceptible to crown rust, resistant to smut, and moderately resistant to halo blight.

Malting Barley

Of the six recommended barley varieties Montcalm and O.A.C. 21 are the only ones having sufficiently high malting quality to enter the malting grades. Montcalm is the more popular variety, being a high yielder and suitable for both malting and feed purposes. The grain of both of these varieties has blue aleurone.

Montcalm — This variety was developed at Macdonald College, Quebec, from the cross Michigan x (Common Six-rowed x Mandscheuri) and was distributed in 1946. It is a six-rowed, smooth-awned, medium-late variety of high malting quality, with straw of medium length and strength. Montcalm is susceptible to stem rust, leaf rust, and loose smut, moderately resistant to false loose smut, and moderately susceptible to covered smut. In the absence of severe disease epidemics, Montcalm is a high yielder in all soil zones.

O.A.C. 21—The Ontario Agricultural College developed O.A.C. 21 as a selection from the old variety, Manchuria, and released it in 1910. It is a six-rowed, rough-awned, medium-late variety of high malting quality, with straw of medium length and strength. Compared with Montcalm, O.A.C. 21 is lower yielding and more subject to shattering. It is susceptible to stem rust, leaf rust, loose smut and false loose smut, and is moderately susceptible to covered smut.

Feed Barley

Montcalm—As indicated above, this is the leading variety grown for feed as well as malting purposes. The remaining feed barleys, described below, have yellow aleurone, but Gartons contains a mixture of yellow and blue kernels.

Plush—This variety was developed by the Dominion Experimental Farm at Brandon, from the cross Lion x Bearer, and was released in 1938. It is a six-rowed, smooth-awned, medium-late barley, with straw of medium length and strength. It is susceptible to stem rust, leaf rust, covered smut, loose smut, and false loose smut.

Vantage—The Dominion Experimental Farm, Brandon, developed Vantage from the cross (Newal x Peatland) x Plush made in 1938, and released it in 1948. It is a six-rowed, smooth-awned, late-maturing variety, with strong straw of medium length. Vantage yields well under a wide range of conditions, but sometimes under moist conditions is damaged by seedling blight. It is resistant to stem rust, moderately resistant to covered smut, and susceptible to leaf rust, loose smut, and false loose smut.

Titan—This variety was developed by the University of Alberta from the cross Trebi x Glabron and was distributed in 1943. It is a six-rowed, smooth-awned, medium-early variety with very strong straw of medium length. Titan is susceptible to stem rust and leaf rust, and is resistant to covered smut, loose smut, and false loose smut.

Gartons—This barley was introduced from England about 1928, in a commercial lot of seed. It is a six-rowed, rough-awned, early-maturing variety, with very weak straw of medium length. Gartons is moderately resistant to stem rust, and false loose smut, moderately susceptible to covered smut and susceptible to loose smut. It is recommended for use only when extremely late sowing is necessary. Under these conditions Gartons yields more than the other recommended varieties.

Flax

The four recommended varieties, Rocket, Redwood, Sheyenne, and Redwing, are all blue-flowered, brown-seeded types, with satisfactory length and strength of straw. Other information follows.

Rocket—The Cereal Division, Central Experimental Farm, Ottawa, originated Rocket from the cross Argentine 8C x Redwing. Seed was distributed in 1947. It is a late-maturing, high-yielding variety, resistant to rust, moderately resistant to wilt, and moderately susceptible to pasmo.

Redwood—The University of Minnesota, in co-operation with the United States Department of Agriculture, developed this variety from the cross C.I. 980 x Redson. It was licensed in Canada in 1951. This flax is a late-maturing, high-yielding variety, resistant to rust and wilt and moderately resistant to pasmo.

Sheyenne—The North Dakota Agricultural Experiment Station developed this flax from the cross Ottawa 770B x Buda. It was distributed in Canada in 1947. Sheyenne is an early-maturing, medium-yielding variety and is resistant to rust and wilt, and moderately resistant to pasmo.

Redwing—This variety was developed at the Minnesota Agricultural Experiment Station, by selection in an imported stock, and was released in Canada in 1932. It is an early-maturing, medium-yielding variety, susceptible to rust, resistant to wilt, and moderately susceptible to pasmo.

Rye

Dakold—This is a high-yielding, winter-hardy variety of fall rye, with seed color varying from green to yellow. Dakold is the most suitable variety for Manitoba conditions.

Prolific—This green-seeded spring rye is a high-yielding variety.

—Courtesy of Howard Smith Paper Mills Limited.

A clean, firm seed-bed helps to ensure a heavy stand of flax

CROP SEQUENCE

One of the more commonly used crop sequences followed under straight grain growing is: summerfallow, wheat, oats or barley, oats or barley. Wheat is usually placed in the preferred position, thereby assuring the crop an ample supply of moisture. In some districts barley has taken over this position. Flax, at one time considered hard on the land, has been proven no more so than the cereals. It does not, however, compete well with weeds. Due to differing nutrient requirements of the various crops and the build-up of plant diseases, crops of the same variety should not be planted on the same land two years in succession. A satisfactory crop sequence should include the periodic seeding down to grass or a grass-legume mixture which not only maintains soil fertility but safeguards it from the ravages of erosion. Crop rotations suitable for farms on which livestock are kept may be found in Manitoba Department of Agriculture publication, "Balance Manitoba Farming With Forage Crops."

CULTURAL PRACTICES

Wheat, Oats and Barley

Cultural practices for wheat, oats, and barley are similar, differing only as to rate of seeding, except in the case of fall rye. Therefore, wheat, barley, and oats are treated as one for the purpose of this discussion.

Seed-bed Preparation—On summerfallow land most of the seed-bed preparation takes place during the fallow year. Two types of summerfallow are in general use. Plowed fallow is adapted to the heavier soil and more favorable moisture areas where wind erosion hazard is at a minimum. Plowless fallowing is practised on lighter soils where wind erosion is a constant threat.

Under the plowed fallow plan the stubble land may be cultivated or "one-wayed" the preceding fall. This will avoid burying the weed seeds too deeply and will encourage them to start growth in the fall, or early in the spring. The land should then be plowed in June, and cultivated thereafter as often as may be necessary to keep down weed growth. It is not necessary to keep the fallow absolutely black. That will make the operation unnecessarily costly. It should be remembered, however, that moisture conservation is a primary objective, and maximum saving of moisture will be achieved by permitting a minimum of plant growth on the fallow. If perennial weeds, such as sow thistle, Canada thistle or field bindweed are present the cultivation will have to be more frequent because the object then is to prevent re-storage of food in the underground parts.

Under the plowless fallow plan it is preferable to begin the operation the preceding fall by cultivating, "one-waying" or shallow plowing. The land is then cultivated during the fallow year as often as is necessary to keep weeds from making extensive growth and wasting the soil moisture.

Intertilled crop land, like summerfallow, requires a minimum of further preparation. In general it need not be plowed. Light disking, harrowing or cultivating to level the ridges left by the intertillage is usually all that will be required. If done in the fall the land will be ready for seeding somewhat earlier. If left until spring it will hold more snow.

Legumes should be plowed under as early as possible to conserve moisture and to provide for a longer summerfallow period. Sweet clover where taken for hay should be cut in the bud stage, and alfalfa in early bloom. The land should be plowed immediately after the hay has been removed. Where a seed crop has been taken from the alfalfa the moisture situation will be much less favorable and it may be inadvisable to attempt to grow an early sown grain crop on it the next year.

The treatment of stubble land will be governed by the texture of the soil, and consequent wind erosion hazard and the amount and kind of weeds present. The heavier soils, in the absence of serious weed

infestations, should generally be tilled in the fall, as soon as possible after the crop has been removed. Uusally it is best to leave the land rough until spring, by which time alternate freezing and thawing will have mellowed it so that light tillage will reduce it to a satisfactory seed bed. Leaving it rough will catch more snow and minimize such soil blowing. One-way disk-tilling and cultivating have largely supplanted mold-board plowing. The choice of implement will depend largely on local conditions: availability of moisture, of implements, pressure of other work, etc. Because of the hazards of blowing in the fall and early spring, light lands are better tilled in the spring. They should be surface worked so as to leave the trash on top. (See Weed Control page 14.)

Seeding Date—If spring weed control is not a factor wheat, oats, and barley may be sown as early in the spring as the land will permit. The Dominion Experimental Farm, Brandon, has found that highest yields of these crops are obtained when seeding is done within two weeks of the time that work may be started on the land. Sharp reductions in yield accompany delay beyond this period.

Seeding Rate—Rate of seeding depends upon size of seed, germination, fertility of soil and moisture supply. The standard rates for good seed, under average conditions of soil fertility and rainfall are as follows:

Common or bread wheat	1½ bushels
Durum wheat	1¾ to 2 bushels
Barley — 6-row	1½ bushels
Barley — 2-row	1¾ to 2 bushels
Oats, smaller seeded	2 bushels
Oats, larger seeded	3 bushels

These rates would be decreased with smaller seed, with lighter less fertile soils and in drier areas. They would be incresased with reduced germination. Higher rates are sometimes recommended where increased competition with weeds is desired.

Depth of Seeding—Two inches is a satisfactory depth for wheat, oats or barley. The depth should be such that the seed reaches moist soil. In general, on lighter soils deeper seeding is necessary than on heavy soils.

Method of Seeding—The grain drill is the most popular implement for seeding. The double-disk drill is most widely used. Press wheels are effective on soils of such texture or condition that the wheels do not pick up and accumulate soil.

Flax

Flax production should be attempted only on land of good quality that is relatively free of weeds. Its place in a crop sequence in order of preference is usually after: (1) intertilled crop, (2) legume crop,

(3) summerfallow, (4) grass sod crop, (5) cereal crop.

If the summerfallow is known to be relatively free of weed seeds, it is the preferred place for flax. It is a poor competitor of weeds, and therefore does not overgrow, as do wheat, oats and barley, such common weeds as mustard, lamb's quarters, stinkweed and red-root pigweed, which are frequently abundant on summerfallow. Since the advent of 2,4-D, the objection to flax on summerfallow is not nearly so great. When applied as recommended 2,4-D will control all of the weeds named without damaging the flax. Land infested with wild oats should not be seeded to flax.

Seed-bed Preparation—A firm seed-bed is of major importance because flax seed is small and should be planted shallow. Packing is best secured by the use of the cultipacker or drag harrows. Otherwise the same practices apply as for cereals.

Flax usually does well on newly broken sod. Breaking should be done during the preceding summer or early fall. Where the sod is of grass such as brome that has underground stems breaking should be done early enough to permit backsetting after regrowth of the grass starts in the early fall. Such additional cultivation and packing will then have to be given in the spring as may be required to produce a smooth firm seed bed.

Surface tillage ensures a trash cover that checks erosion

Seeding—If the land is clean so that further cultivation is not required for weed control, flax should be sown early. It is not particularly sensitive to spring frosts and it is safe to seed ten days or two weeks after wheat seeding normally begins. As in the case of the cereal crops, delayed seeding is nearly always accompanied by reduced yields.

When seeding need not be delayed on account of weed growth Rocket and Redwood, late-maturing, heavy yielding varieties, are

recommended for southern Manitoba. Earlier maturing varieties such as Redwing and Sheyenne should otherwise be grown. These are not reduced by late seeding as are later maturing varieties. Delayed seeding is particularly important if the weeds involved are resistant to 2,4-D, such as wild buckwheat or wild oats.

Twenty-five to forty pounds of flax seed per acre provides sufficient range to cover the variation in size of seed of the different varieties commonly grown, and for the variable soil and moisture conditions encountered.

Depth of seeding is highly important. Owing to the small seed it should not be sown more than 1 to 1½ inches deep. Shallow seeding promotes more rapid and uniform germination.

As for wheat, oats, and barley press wheels will be of advantage, especially on lighter soils. Where the "tiller-combine" is used on stubble land it should be followed by packing.

Rye

Fall rather than spring rye is generally grown in Manitoba. Although this crop will respond to high soil fertility and good cultural practices it will do better on relatively poor soils than any other crops, with the possible exception of buckwheat. The sandier lands, which are unsuitable for wheat, oats or barley are frequently sown to rye. Fall sown rye will help control soil erosion. Because of its early establishment and early growth in the spring it tends to overcome competition from wild oats, and, will often mature in advance of them.

While the best yields will be obtained with good seed-bed preparation as for other cereals, rye is frequently seeded with a minimum of such preparation. Seeding on stubble without any previous preparation is an accepted practice. The crop should be seeded in late August or early September at the rate of about 1¼ bushels per acre. The depth and method of sowing are the same as for wheat, oats and barley.

Cultural practices for spring rye are essentially the same as for spring wheat. Like fall rye it will do relatively well on light or sandy soils. Spring rye has a smaller seed than fall rye, and one bushel per acre will ordinarily be sufficient. Spring rye is sometimes sown on stands of fall rye in the spring if the latter appear too thin.

FERTILIZERS

Satisfactory yields of crops can be secured only by maintaining soil fertility. Deficiencies of plant nutrients may be supplemented by the use of commercial fertilizers, barnyard manure and crop rotations which include legumes.

Commercial Fertilizers—The chief constituents of commercial fertilizers are nitrogen, phosphate and potash. Fertilizers may contain one, two or all three of these. The numbers appearing on a bag of fertilizer indi-

cate the percentage of the nutrients present and in the following order: nitrogen, phosphate, and potash. For example, 16-20-0 indicates 16% nitrogen; 20% phosphate, and no potash. Other elements such as sulphur, may be present although not indicated. Commercial fertilizers give favorable results in all soil zones, but in drier years the response is less pronounced. Large amounts of combine straw and stubble, when worked into the soil, may cause a temporary shortage of nitrogen. Fertilizers carrying a higher percentage of nitrogen may be used to advantage to offset this condition. Potassium is generally in ample supply. Fertilizers containing potash have not given favorable response except in certain small well-defined areas.

Fertilizers containing ammonium phosphate tend to maintain soil fertility and increase yields. Fertilized crops show greater root development, additional tillering and rapid early growth. Greater strength of straw, earlier maturity and less root-rot, especially browning root-rot, can also be expected.

Application of Fertilizers—Commercial fertilizers are best applied in the drill row with the seed by use of an attachment to the grain drill. General recommendations on black soils are: 40 to 60 lbs. 11-48-0 on summerfallow; 60 to 80 lbs. 16-20-0 on stubble land. For further information on rates see "Field Crop Recommendations for Manitoba," obtainable from Agricultural Representatives' offices.

WEED CONTROL

Cultural Control—If weeds, particularly wild oats, are a serious problem, stubble land should not be plowed in the fall, but given light tillage as soon after harvest as possible. This will stimulate early germination of weed seeds which will then be killed, either by subsequent cultivations or by freezing. Not all weed seeds will germinate under this treatment, however. A very large proportion of the seeds of wild oats, and a number of other species fail to germinate the year they are produced. One should avoid turning these under deeply, because they will then lie dormant and be a constant source of trouble when turned up later, or when stimulated to later germination from other causes. Therefore, additional fall work should be limited to surface working. Further cultivation in the spring may be required. For wheat or oats there will generally be time only for such tillage as may be required to make a satisfactory seed bed. Where a tiller-combine is available this may, in many cases, be used without previous spring tillage. The possibility of using other implements such as drag harrows, or field cultivator, will depend upon the amount of trash present. These implements should preferably be followed by a packer. If barley is to be sown, more spring cultivation can be given, in response to the need for more thorough weed control, since barley will endure later seeding better than either wheat or oats.

Chemical Control—The chemical 2,4-D is the cheapest and most effective of those now available. The secret of success in its use lies in adjusting the dosage to the type of weeds involved and applying it at the proper time. To ensure against crop damage the amount of 2,4-D

used will be determined by the prevalent weeds. The chemical should be applied when the weeds are highly susceptible and the crop is in a resistant stage. To limit weed competition with the crop, treatment should be applied at the earliest safe period.

Esters and amines are commonly used. The esters are more potent and more rapid in their action than the amines, but, must be used with somewhat greater caution to avoid damage to the crop.

Although all cereals are relatively resistant to 2,4-D, they may be severely damaged when treated at certain stages of growth, especially when heavier rates are used. Wheat is generally the most resistant and oats the most susceptible of the cereals. Flax is more susceptible than the cereals, with the possible exception of oats. Wheat and barley are highly susceptible in early seedling stages, and also in the shot-blade or boot stage. Treatment should be made between the 6 and 12 inch stages or between the 3-leaf and shot-blade stage.

Oats differ from wheat and barley because the most susceptible period occurs when the latter are most resistant. Oats are also susceptible in early seedling stages. This leaves only short periods immediately before and after the six-inch and the early shot-blade stages, when they may be treated with reasonable safety. Emphasis should be placed on low rates; it may be advisable to use amines rather than esters.

Flax is most tolerant in early stages of growth. It is reasonably safe to treat any time after the two-leaf or seed-leaf stage, until shortly before it reaches the bud stage.

The accompanying table shows the adjustments in rates of amines and esters to the different crops and weeds, based on their degree of susceptibility. For information as to susceptibility or resistance to any particular weed, the reader is referred to "Steps Toward Effective Weed Control" published by the Manitoba Department of Agriculture.

Timely, effective, and cheap application of chemicals for weed control is now possible

Suggested Amounts of 2,4-D Acid per Acre to Use as Spray on Cereals or Flax to Control Weeds.
(As recommended for 1952)

Type of Weed and Reaction to 2,4-D	Formulation	(Ounces Acid per Acre) Wheat and Barley	Flax and Oats
Annual Weeds	Amine	3½ to 7	3 to 5
(Susceptible)	Ester	3 to 5	2½ to 4
Annual Weeds	Amine	5 to 10	4 to 8
(Intermediate)	Ester	4 to 8	3 to 6
Perennial Weeds	Amine	5 to 10	4 to 8
(Top growth control)	Ester	4 to 8	3 to 6

Green foxtail is often a serious weed in flax, particularly in late sown crop. It is resistant to 2,4-D, but can be controlled by spraying with TCA at 5 to 7 pounds per acre. It should be applied when the green foxtail is less than 3 inches tall and the flax in the early stages of growth.

HARVESTING

Wheat, Oats, Barley and Rye—Straight-combining is not a general practice because of the unevenness of crop maturity, the presence of weeds, and because of the danger of loss through shattering if the crop is left standing until dry enough to combine. Immature grain and green weed material are likely to cause storage problems. As a rule, wheat, oats, and barley may be cut or swathed several days before they are fully ripened without loss of yield, grade or quality. Malting barley, however, should be allowed to ripen as competely as possible with due regard to avoiding losses, to ensure mature kernels suitable for malting purposes. Where varieties susceptible to shattering are grown, operations should commence several days before the crop reaches maturity. Wheat and barley may be tested for ripeness by pressing the kernel with the thumb nail. The grain is considered ripe when a fair pressure only slightly dents the kernels. The time to start cutting will depend on the size of the field, the amount of harvesting machinery and power available. Swathed grain should be cut high enough for the stubble to hold the swath well up from the soil.

Rye should be cut when the grain is in the late dough stage. The seed shatters or shells quite easily, and it is necessary to cut the crop before it is completely ripe. Care should be taken when threshing rye to avoid cracking the kernels.

Special care should be taken in combining or threshing malting barley. Best results will be secured by running the cylinder as slowly as possible and yet with sufficient speed to thresh the grain out of the head. Speeds above 6200 R.P.M. will damage grain regardless of concave clearance. Concaves should not be set to take off all the awn. Barley buyers do not object to a small amount of awn being left on the kernel. Cylinder speed and concave clearance are directly related. The lower the cylinder speed the closer can be the clearance. The sieves should be adjusted for the least possible "return," thereby decreasing the number of skinned and broken kernels.

Flax—Well ripened flax is not difficult to cut or swath. Late seeded flax seldom ripens thoroughly and is difficult to cut because of the toughness and gumminess of the stems. If a binder is used twine is not essential as the flax clings together in the sheaf; unbound sheaves dry out better. Flax may be straight-combined if harvesting is delayed until frosts kill all green growth. One of the hazards from swathing flax is that wind may blow the light fluffy swath about, causing considerable loss. To reduce cracking in flax, the "return" should be adjusted so that it does not fall directly on the cylinder. Bright clear weather is essential in threshing. Flax is difficult to thresh if the weather is cloudy and damp as the fibres tend to wind on revolving parts. Flax rolls may be used to advantage on some combines.

STORAGE

Wheat, oats, barley, and rye with a moisture content over 15% cannot be stored safely as it is likely to heat and spoil. Where such grain is binned on the farm, it is well to have quarter-inch iron rods 10 feet apart pushed vertically into the bin so that they extend from the bottom of the bin to a few inches above the top of the grain. Every few days, particularly during warm spells in March and April these rods should be examined. If they are warm a few inches below the surface the grain is heating. Immediate removal of heating grain to a place where it can be aired and dried is the only way to save it.

Flax containing more than 11% moisture cannot be stored safely. As flax packs closely together, it will often heat in the bin if the moisture content of the weed seeds threshed with it is too high. Flax may be checked for heating as outlined above, and if necessary should be aired and dried.

PLANT DISEASES

Stem Rusts—In Manitoba stem rusts of wheat, oats, and barley caused losses averaging more than $15,000,000 a year from 1916 to 1937. The introduction and rapid spread of rust-resistant varieties of wheat and oats, starting with Thatcher wheat in 1936, reduced losses greatly. The stem rust fungus can produce new races in nature, particularly where barberries occur; some of these new races can attack crop varieties that were rust resistant when they were released. The most destructive new race of stem rust is 15B, which attacks all the commercial varieties of common and durum wheat grown in Manitoba.

The red spores by which the rust fungus spreads during the growing season do not over-winter in Western Canada. They live over on winter grains and wild grasses in Texas and northern Mexico, and gradually are blown north with winds as the season advances. Rust outbreaks in Western Canada depend not only on suitable weather conditions and the presence of susceptible varieties of grain, but also on weather conditions where the spores over-winter. Exceptionally dry weather in Texas in the winter of 1950-51, saved Manitoba wheat from stem rust damage in the 1951 season. The threat of rust losses will remain until new varieties resistant to race 15B are available. In the

meantime it is important that wheat be sown as early as possible, and that farm practices, such as the application of phosphate fertilizers, be followed which will help the the crop to mature before rust infection becomes heavy, thus letting it escape with the least possible damage.

The variety of stem rust that attacks wheat also attacks barley. Because barley ripens early it usually escapes severe rust damage. While some varieties of barley have been developed which are resistant to wheat stem rust, they are susceptible to rye stem rust. Rye stem rust occurs on rye as well as on barley, but because fall-sown rye ripens early in the season, it usually escapes damage.

The variety of stem rust that occurs on oats is quite different from the varieties occuring on wheat, barley, and rye. The rust resistant varieties of oats that were first produced remained free of stem rust for several years, but the build-up of new races of rust has made it necessary to breed new resistant varieties.

Leaf Rusts—Wheat and oat leaf rusts were thought to be of minor importance in the years when stem rust caused severe losses. When the stem-rust-resistant wheat, Thatcher, was released, it was found that leaf rust reduced its yield appreciably in some years. Renown, Regent, and Redman wheats also were resistant to leaf rust when they were first distributed, but within a few years new races increased and attacked these varieties heavily. Lee wheat, resistant to leaf rust, is unfortunately just as susceptible to stem rust race 15B as other commercial wheats.

The stem-rust-resistant oat varieties, Vanguard, Ajax, and Exeter, were also resistant to crown rust (leaf rust) when they were first released. As in the other cereal rusts, new races of crown rust appeared and multiplied as the new oat varieties became widely grown, making it necessary to utilize other sources of resistance.

The leaf rusts of barley and rye occur in Manitoba, but are not usually important because these crops mature before leaf rust can cause much damage.

Smuts—Bunt (or stinking smut) and loose smut of wheat; covered, true loose, and false loose smuts of barley; and the covered and loose smuts of oats, are each caused by a different fungus. Bunt of wheat, the covered and false loose smuts of barley, and the covered and loose smuts of oats, can be grouped together because of similarities in the way they develop, and the way in which they can be controlled. The spores of these smuts contaminate the surface of the threshed grain, and in barley and oats may get under the surface layers of the hull. When infected grain is sown in the spring, the smut spores germinate and infect the young seedlings.

Because the spores of the seedling-infecting smuts are carried on or near the surface of the grain, they can be controlled effectively by the use of organic mercury seed-treatment chemicals. Some varieties of cereals are resistant to the surface-borne smuts, but chemical seed treatment, at least for the present, provides more dependable control than do resistant varieties.

The loose smuts of wheat and barley are borne internally in the seed. Some of the spores, blown away from smutted heads at flowering time, may lodge in healthy heads, germinate, and penetrate the

embryo of the developing seed. There the fungus threads are not affected by ordinary chemical treatments that may be applied later. The hot water treatment, although it controls loose smut, is difficult to apply on a large scale unless special facilities are available. It is simpler to control loose smut by buying registered seed known to be free from loose smut.

Root Rots—Common root rot, caused by fungi that live in the soil or are present in the seed, affects all the cereal crops. It is usually most severe in dry, light, or alkaline soils. Plants affected in the seedling

1. **Loose smut of baley**
2. **Covered smut of barley**
3. **Loose smut of oats**
4. **Covered smut of oats**
5. **Loose smut of wheat**
6. **Ergot of rye**
7. **Ergot of barley**

stage may be killed. If the weather turns hot and dry, the surviving infected plants may die prematurely because their diseased roots cannot take up enough water to keep them alive.

Seed treatment with organic mercury chemicals controls the seed-borne phase of some root-rot fungi, and may protect young seedlings from early attack by soil fungi. Practices that produce vigorous, fast-growing plants, such as the use of fertilizers, and shallow and early seeding, tend to decrease root rot injury.

Browning root rot, caused by a soil fungus, occasionally damages young wheat plants following summerfallow. Affected plants are rarely

killed, but they are retarded in growth and maturity, and may in some seasons be heavily damaged by rust or frost. The disease occurs in soils with a low available phosphorous content. The application of phosphate fertilizers usually gives good control.

Victoria blight of oats, caused by a soil-and-seed-borne fungus, was first reported in Canada in 1947. The fungus attacks only those oat varieties derived from Victoria, which was included in the parentage of most of the crown-rust-resistant oats. Chemical seed treatment controls the fungus on the seed, but because it is widespread in the soil, the only effective control is to grow resistant varieties.

Leaf Spots—Spots can be found on the leaves of cereal plants in most fields, and sometimes they cause considerable damage. Some leaf diseases, such as spot blotch and stripe of barley, are caused by fungi. Others, such as halo blight of oats and black chaff of wheat, are caused by bacteria. Seed treatment with organic mercury chemicals gives effective control of barley stripe, but only partial control, if any, of other fungus and bacterial leaf diseases. Crop rotation and field sanitation reduce infection. Gray speck of oats is induced by a deficiency of manganese in the soil, and is aggravated by dry weather. False stripe of barley, formerly thought to be due to unfavourable environmental conditions, may be caused by a virus.

Head and Seed Discolorations—Wheat and barley are subject to discolorations which may be caused by fungi (black point or kernel smudge), or bacteria (bacterial black chaff). Chemical seed treatments and field sanitation may help to reduce infection. Some head discolorations of wheat and barley are caused by the growth of fungi that do not attack healthy tissues, but develop on dead or drying plant parts. If the weather is wet at harvest time, growth of these dark molds may be profuse, particularly on heads killed by root rot, drought, or other causes. Other discolorations, such as false black chaff, may be induced by high temperatures, or by the unsuccessful attack of rust on rust-resistant varieties of wheat.

Oat Blast—"Blasting", or the occurrence of undeveloped white spikelets, particularly near the base of the panicle, is sometimes conspicuous in oat fields. It results if drought, severe leaf disease, or other factors check plant growth when the panicles are in an early stage of development. Early seeding may reduce blasting by enabling the panicles to form and fill before the weather becomes hot and dry.

Flax Rust—The black spores of the flax rust fungus over-winter in Western Canada. They germinate in the spring to reinfect young flax plants, and give rise to the red spores which spread the disease during the growing season. Infections can be reduced by crop rotation, and by sowing flax as far as possible from fields in which flax rusted the previous year. Rust resistant varieties of flax provide the best means of controlling the disease. New races of rust arise in nature, however, and some of them can attack varieties, such as Dakota, that were resistant when they were distributed. Rust damage on susceptible varieties may be lessened by early seeding, which enables the seed to fill before rust infections become severe.

Pasmo—This disease can occur on all the above-ground parts of flax plants. Pasmo is rarely conspicuous until the plants finish blooming. If infections start early in a moist, warm season, seed yields may be severely reduced. Careful cleaning of the seed removes many of the light, infected kernels, and chemical seed treatment also helps to prevent spread of the disease by seed. The most important source of the pasmo fungus each season is the diseased flax stubble and debris where it over-winters; therefore crop rotation and field sanitation are important control measures. No flax varieties are highly resistant to pasmo, but some, like Viking, are extremely susceptible, and should be avoided.

Flax Wilt—Caused by a soil-borne fungus, flax wilt may kill plants in patches, or throughout the field. Some fields of the old variety Crown have been destroyed by wilt in the last few years. The recommended varieties are all fairly resistant to wilt. No varieties are immune, and crop rotation should be practised to avoid build-up of the fungus in the soil.

Seedling Blight—This disease of flax may be caused by several soil fungi. The fungus usually responsible is most active in loose, well-worked soil, particularly on summerfallow or land that has been spring-worked to control weeds. Packing the soil results in faster germination of the flax, and slows down the spread of the fungus. Flax plants become resistant to seedling blight as they grow older. Chemical seed treatment may give them some protection during the early seedling stage. Early seeding may allow plants to get ahead of the fungus before weather conditions are most favorable for its development.

Heat Canker—Heat canker of flax is caused by overheating the young stems at the soil line. Affected seedlings may recover, only to die if the weather turns hot and dry later in the season. Control measures include fairly heavy seeding, and seeding north and south, so that the young plants are shaded at the soil line when the sun is in the south, at noon; and early seeding, to get plants past the most susceptible stage before the weather becomes hot.

Seed Cracking—Flax seed threshed in dry weather may have tiny cracks in the seed coat, too small to see without a microscope. These cracks have no effect on the value of the flax for crushing, but if the seed is sown they may be penetrated by soil fungi that rot the seed. Treatment with organic mercury chemicals protects cracked seed from rotting, and may improve germination greatly.

Ergot—Although most common on rye, ergot may be found on wheat and barley. If grain containing numerous ergot bodies is fed to live stock it may cause gangrene, and the loss of hooves, horns, and limbs. Flour made from such grain is poisonous and may cause illness or death. Ergot infection of cereals comes largely from spores produced in grasses in headlands or nearby hay fields. Mowing the grass as soon as it comes into flower, and careful cleaning of seed grain to remove ergot bodies, help to control the disease.

DISEASES OF CEREALS AND FLAX

Crop and Disease	Plant Parts Affected	Main Symptoms	Main Control Measure
Wheat			
Leaf rust	Leaves	Small, round or oval, dusty, orange-red pustules, turning black as plants mature.	Sow resistant varieties. Sow early to escape damage.
Stem rust	Stems and leaves	Elongate, dusty, red-brown pustules, turning black as plants mature.	Sow resistant varieties. Sow early to escape damage.
Browning root rot	Leaves and roots	Leaf tips pale brown, plants stunted in patches, small brown spots on roots. Usually on crops after fallow.	Fertilize soil with ammonium phosphate 11-48 at recommended rate.
Common root rot	Stem base and roots	Brown patches on base of stem. Roots brown or rotted.	Sow good seed, treated with a recommended chemical,* in good soil. Sow shallow.
Bunt	Heads	Kernels replaced by dark gray smut balls, filled with black, dusty mass.	Treat seed with a recommended chemical.*
Loose smut	Heads	Chaff and kernels replaced by loose, black, dusty masses which blow away.	Sow Registered or Certified seed. Treat enough seed for seed plot with hot water.**
Head discolorations	Heads, necks	Brown to black spots, streaks, or patches on chaff, rachis or neck.	Sow resistant varieties. Treat seed with a recommended chemical.*
Ergot	Heads	Kernels replaced by purplish-black, elongate, hard bodies.	Mow headlands before grass comes into head. Clean the seed to remove ergot bodies.
Seed discoloration	Seeds	Brown or dark-brown discoloration, especially near embryo end of seed.	Treat with a recommended chemical.*
Barley			
Stem rust	Stems and leaves	Elongate, dusty, red-brown pustules, turning black as plants mature.	Sow resistant varieties. Sow early to escape damage.
Common root rot	Stem base and roots	Brown patches on base of stem. Roots brown or rotted.	Sow good seed, treated with a recommended chemical,* in good soil. Sow shallow.
Net blotch, spot blotch, speckled leaf blotch	Leaves	Elongate, oval, or irregular brown spots on leaves.	Treat seed with a recommended chemical.* Do not sow barley two years in succession in the same field. Cover barley stubble in neighboring fields.
Covered smut	Heads	Chaff and kernels replaced by black masses of spores.	Treat seed with a recommended chemical.*
False loose smut	Heads	Chaff and kernels replaced by loose, black, dusty masses which blow away.	Treat seed with recommended chemical.* If smut from treated seed occurs in crop it is true loose smut.
Loose smut	Heads	Chaff and kernels replaced by loose, black, dusty massess which blow away..	Sow registered or Certified seed. Treat enough seed for seed plot with hot water.**
Ergot	Heads	Kernels replaced by purplish-black, elongate, hard bodies.	Mow headlands before grass heads. Clean seed to remove ergot bodies.
Seed discolorations	Seeds	Brown to dark-brown discolorations, especially near embryo end of seed.	Treat with a recommended chemical.*

Oats			
Crown rust	Leaves	Small, round or oval, dusty, yellow-orange pustules, turning black as plants mature.	Sow resistant varieties. Sow early to escape damage.
Stem rust	Stems, leaves	Elongate, dusty, red-brown pustules, turning black as plants mature.	Sow resistant varieties. Sow early to escape damage.
Common root rot	Leaves, stem base and roots	Reddish discoloration of leaves, brown patches base of stem and roots, roots rotted.	Sow good seed, treated with a recommended chemical,* in good soil. Sow shallow.
Victoria blight	Leaves, stems and roots	Some seedlings die. Reddish discoloration of leaves, premature death of plants.	Sow resistant varieties.
Covered smut, loose smut	Heads	Chaff and kernels partly or completely replaced by dusty black masses which sometimes blow away.	Treat seed with a recommended chemical.*
Blast	Heads	White, empty spikelets, particularly near the base of the panicle.	Sow recommended varieties. Sow early to get heading before hot weather.
Flax			
Seedling blight	Stems and roots	Seedlings die. Reddish brown patches on roots and stems below soil.	Treat seed with recommended chemical.* Sow good seed, sow early, sow shallow. Pack after seeding on light soils.
Heat canker	Stems at soil line	Young plants turn yellow and fall over. Stem shrunken at soil line, swollen above.	Sow early, at fairly heavy rate. Sow north and south rather than east and west.
Wilt	Leaves, stems, roots	Plants wilt, die, turn brown. Top of stem curves down.	Sow resistant varieties. Practise crop rotation.
Rust	Leaves, stems	Small, round, dusty, orange pustules on leaves, elongate black pustules on stems as plants mature.	Sow resistant varieties. Sow early to escape damage. Cover flax stubble or combine straw. Do not sow flax in or next to fields where flax was grown the year before.
Pasmo	Leaves, stems, bolls	Brown spots on leaves, bolls. Elongate brown patches on stems, alternate with green healthy areas to give mottled appearance.	Avoid very susceptible varieties. Sow early. Cover flax stubble or combine straw. Do not sow flax in or next to fields where flax was grown previous year.
Seed cracking	Seed	Microscopic cracks in seed coat. Germination poor in soil.	Treat seed with recommended chemical.* Prevent cracking by precise adjustment of combine or thresher.
Rye			
Leaf rust	Leaves	Small, round or oval, dusty, orange-red pustules, turning black as the plants mature.	Sow fall rye to escape infection.
Stem rust	Stems, leaves	Elongate, dusty, red-brown pustules, turning black as plants mature.	Sow fall rye to escape infection.
Scald	Leaves, stems	Oval, or irregular pale blotches with a brown margin.	Do not sow rye after rye, or barley, in same field. Mow and rake grass headlands.
Ergot	Heads	Kernels replaced by purplish-black elongate, hard bodies.	Mow headlands before grass heads. Clean seed to remove ergot bodies.

* The following chemicals (not listed in order of merit) are effective against most seed-borne diseases of cereals, except loose smut of wheat and barley: Ceresan M, Panogen, Leytosan, Agrox C, Mergamma C. Mergamma C also controls wireworms.
Formaldehyde and copper-sulphate (bluestone) are not recommended. They should not be used for "damp" cereals or flax.
Dry seed should be treated at least 24 hours before planting, except oats and barley, which should be treated at least a week in advance. "Damp" cereals and flax should be treated not more than 24 hours before sowing. Thorough application and even distribution of chemical on the seed is most important. Most seed-treatment chemicals are poisonous. Guard against inhaling dust or fumes. Wash well periodically during treating to remove chemicals lodging on hands and face.

** To control loose smut of wheat and barley, treat with hot water sufficient seed for a seed plot. Recommended method is as follows: Presoak seed in cool water for four hours. Then dip in warm bath (125° F.) for two minutes, and in hot water (129° F. for wheat and 128° F. for barley) for ten minutes. Cool seed immediately after treatment by dipping in cold water. Then spread seed in an even layer to dry. As hot water may reduce germination, test germination of treated grain to determine correct seeding rate.

Publications Available

● Publications referred to in the text of this bulletin are listed below, and may be obtained from the office of any Agricultural Representative in Manitoba or from the Publications Branch, Manitoba Department of Agriculture and Immigration, Legislative Building, Winnipeg.

No. 242—Balance Manitoba Farming With Forage Crops.

No. 238—Steps Toward Effective Weed Control.

No. 222—Fertilizer Recommendations For Manitoba.

Field Crop Recommendations for Manitoba.